ANSI T11 FIBRE CHANNEL

STANDARDS AND PRODUCTS

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April 30, 1998

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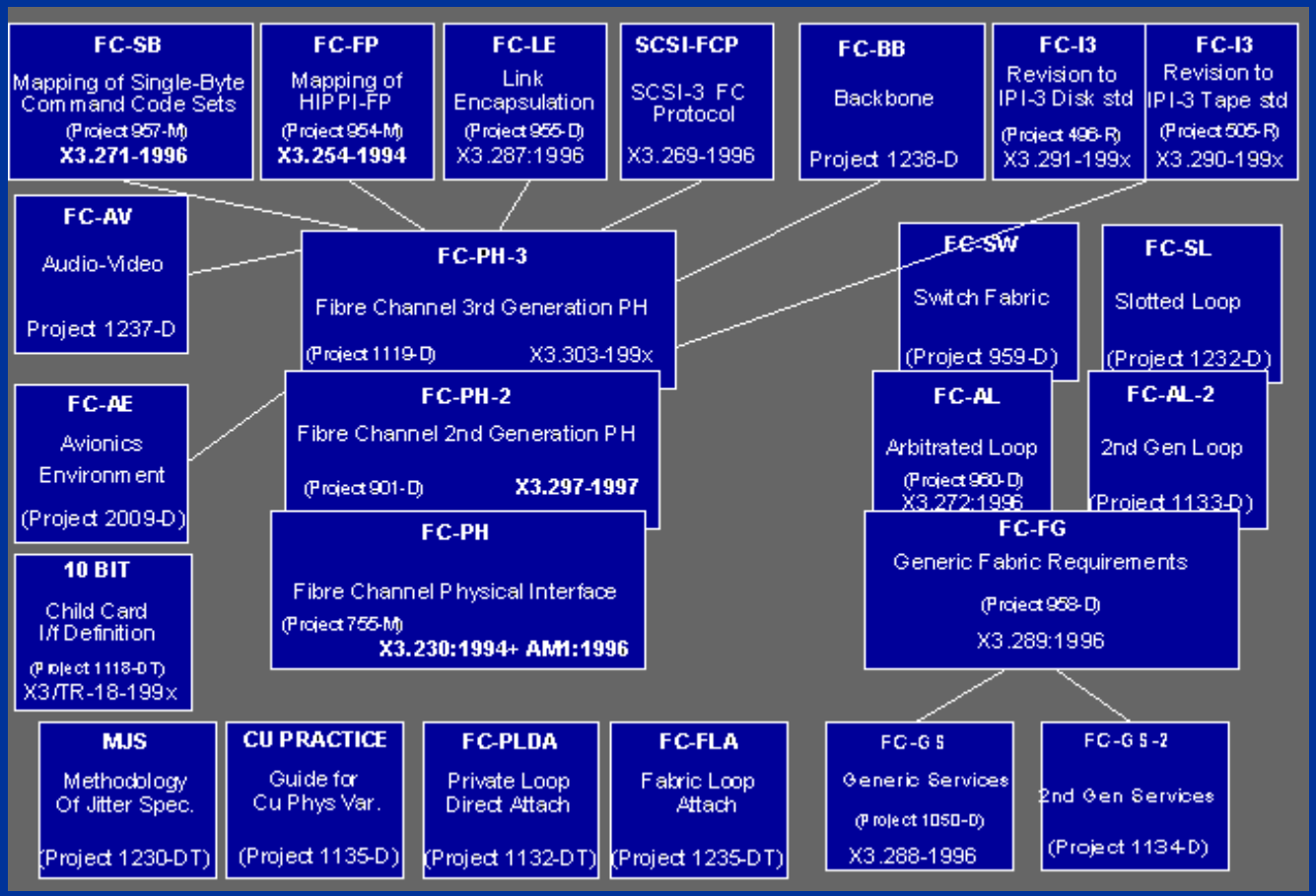
6-Point Helvetica Regular ID Number
Date/initials

TOPICS

- What is Fibre Channel?
- Who is developing Fibre Channel?
- Fibre Channel Projects and Status
- OS-JTF SORTI Overview/Development
- Fibre Channel in Avionics Today

WHAT IS FIBRE CHANNEL?



TODAY'S FASTEST NETWORK

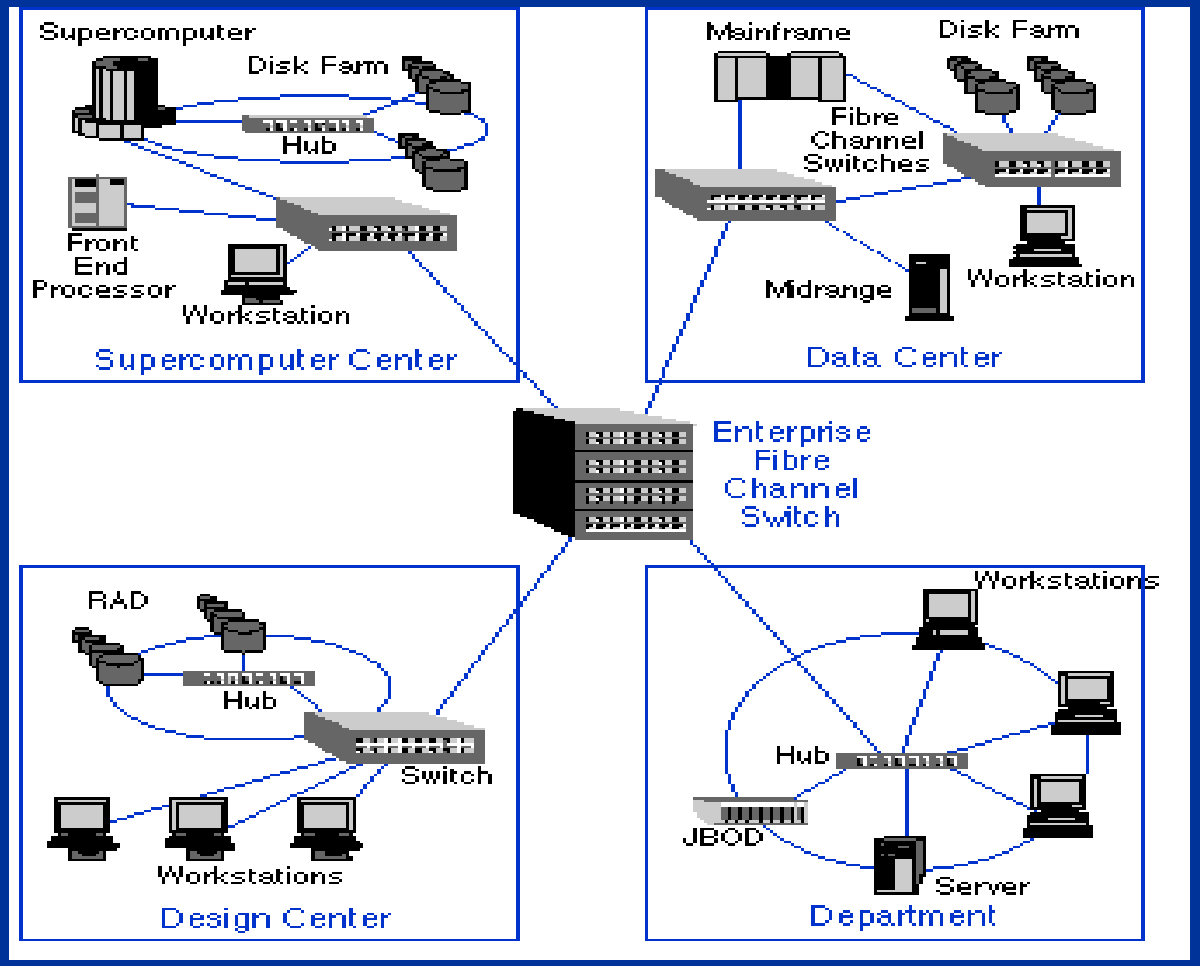
Unbeatable

- Performance
- Connectivity
- Flexibility

Topologies

- Point to point
- Loop
- Hub
- Switched
- Hybrid

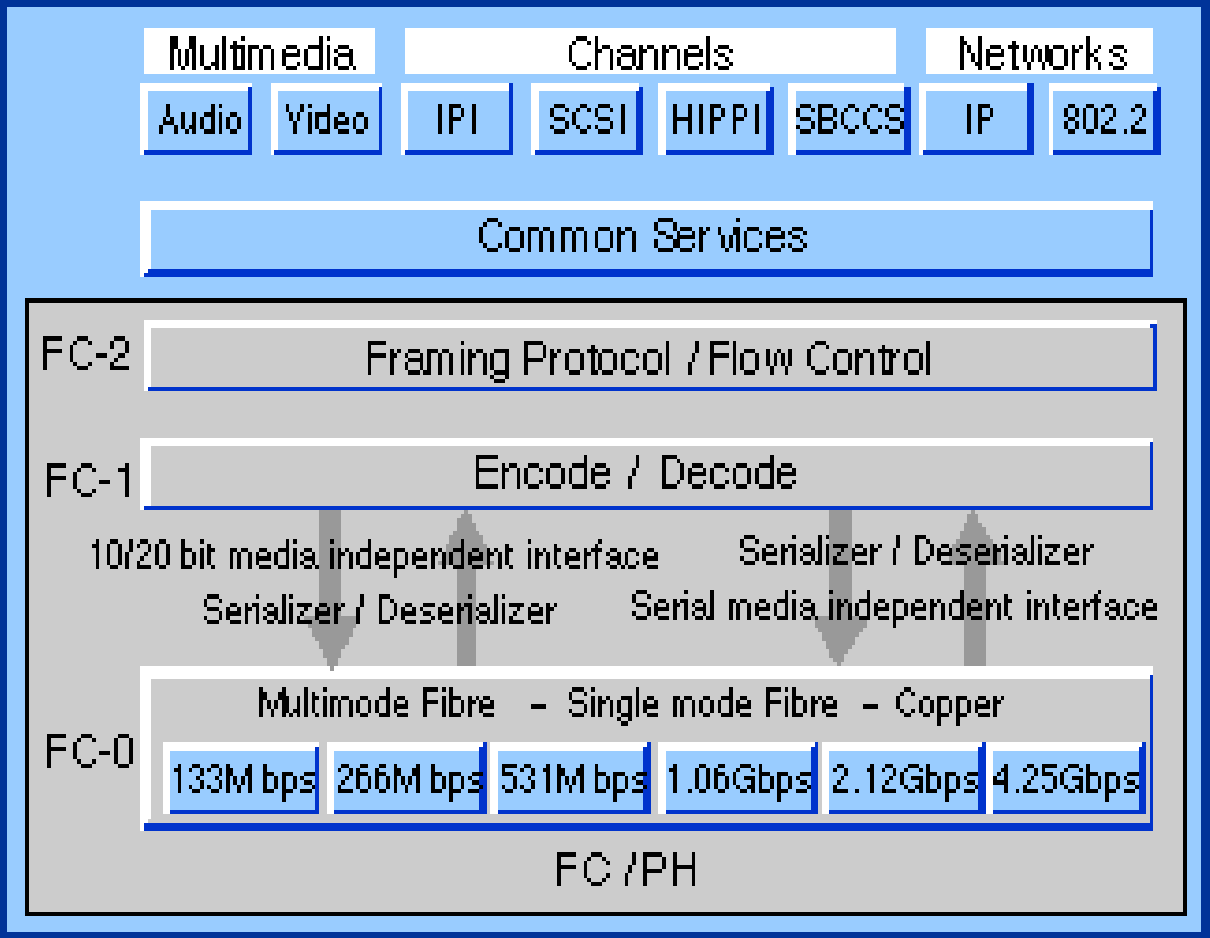
Heterogeneous Environment



OVERVIEW

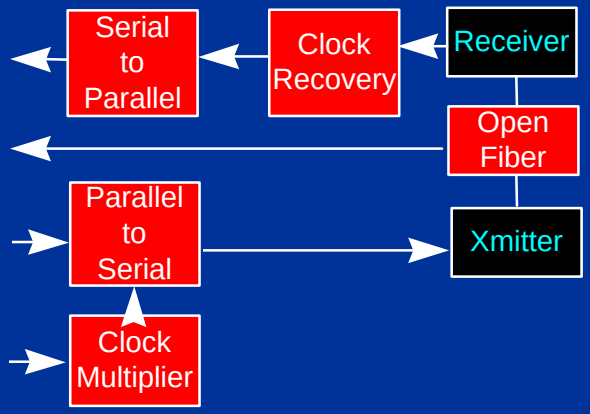
Layered Structure

- **Technology independent**
- **Room for growth**
- **Developed by accredited standards body**



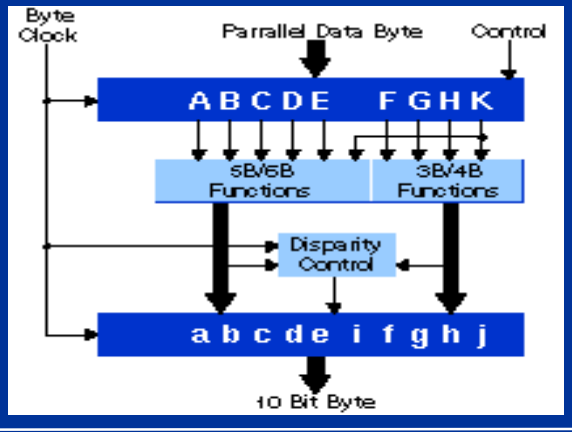
OVERVIEW

FC-0, Physical



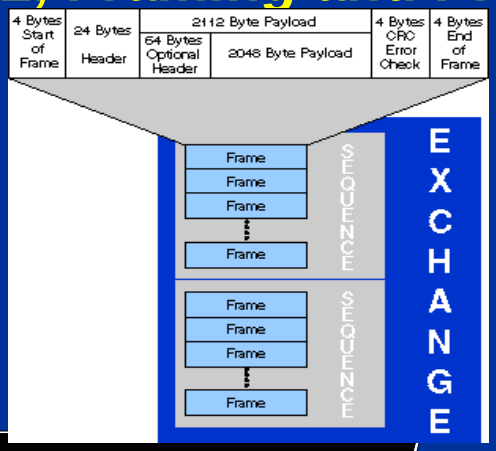
133Mbps
266Mbps
533Mbps
1.06Gbps
2.13Gbps
4.26Gbps
Copper
Fiber

FC-1, 8B/10B Encoding

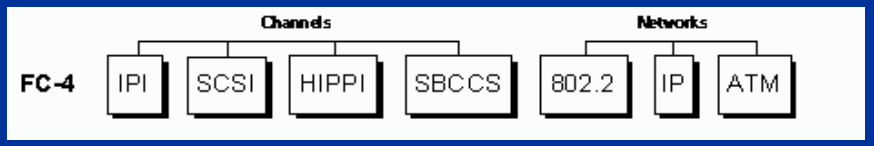


Proven
Robust
Delimiters
Ordered Sets

FC-2, Framing and Protocol



FC-4, Upper Layer Protocols



Interoperable Solutions

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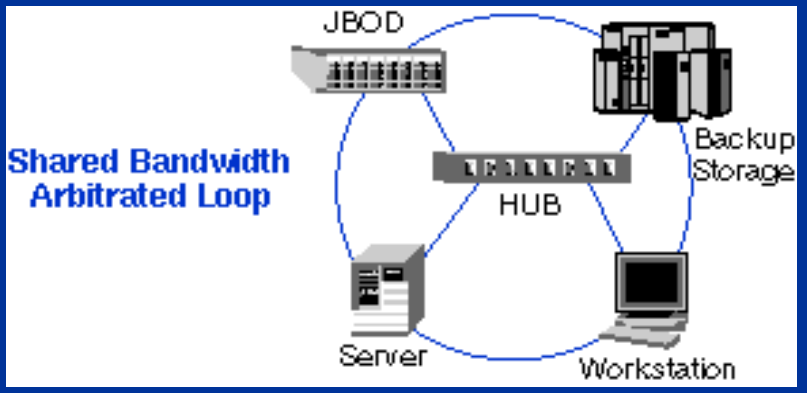
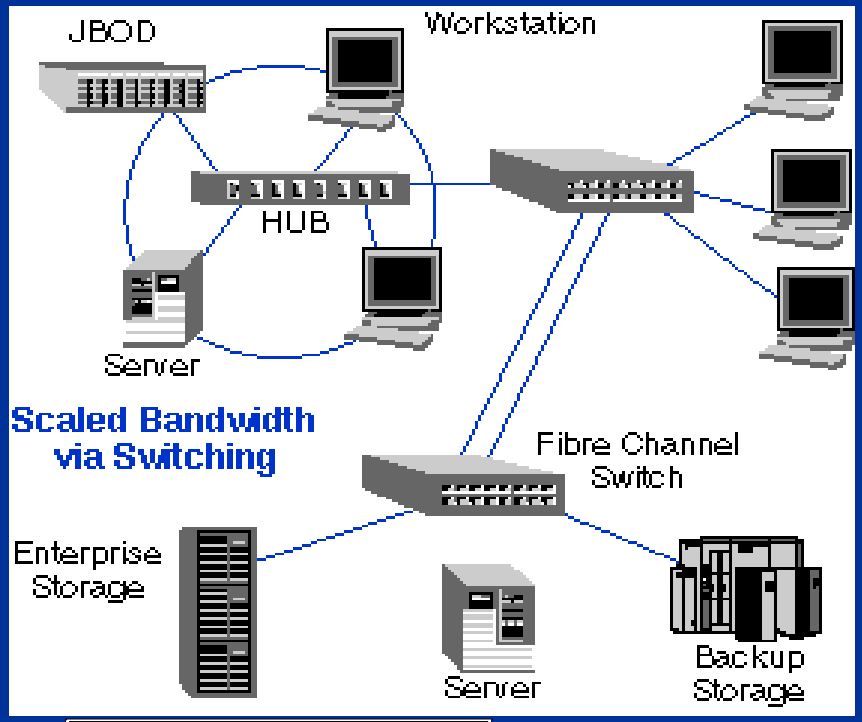
MULTIPLE TOPOLOGIES





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CLASSES OF SERVICE

Class 1

- Guaranteed Bandwidth, Delivery, and Latency
- Connection Service
- End-to-end Flow Control
- In-order Delivery

Class 2

- Guaranteed Delivery
- Connectionless Service
- Buffer-to-buffer flow control

Class 3

- Datagrams
- Connectionless Service

CLASSES OF SERVICE

Class 4

- Fractional Bandwidth
- Guaranteed Bandwidth, Delivery, and Latency
- Connection Service
- End-to-end Flow Control
- In-order Delivery

Class 6

- Multicast
- Guaranteed Bandwidth, Delivery, and Latency
- Connection Service
- End-to-end Flow Control
- In-order Delivery

WHO IS DEVELOPING FIBRE CHANNEL?

ANSI Technical Committee T11 - 82 member companies

- Task Group T11.2 - Fibre Channel Physical Variants
- Task Group T11.3 - Fibre Channel Interconnection Schemes
- Task Group T11.4 - Fibre Channel Protocol Mappings

Fibre Channel Association (FCA) - 60 principal members

- Industry Trade Group
- Promoting Development of all Fibre Channel Markets and Products

Fibre Channel Loop Community (FCLC)

- Industry Trade Group
- Promoting Development of Fibre Channel Markets and Products based on Fibre Channel loop variants

T11 DOCUMENT STATUS

Approved ANSI Standards

FC-AL	Arbitrated Loop	ANSI X3.272:1996
FC-FG	Fabric Generic	ANSI X3.289:1996
FC-FP	HIPPI-FP Mapping	ANSI X3.254:1994
FC-GS	Generic Services	ANSI X3.288:1996
FC-LE	Link Encapsulation	ANSI X3.287:1996
FC-PH	Physical Interface	ANSI X3.230:1994
FC-PH-2	PH Enhancements	ANSI X3.297:1997
FC-SB	Single-Byte Cmd Set - SCSI	ANSI X3.271:1996

STATUS

Projects at NCITS for approval*

FC-AL-2	AL Enhancements	Rev 6.10:1998
FC-FLA	Fabric Loop Attach	Rev 2.70:1998
FC-PH-3	PH Enhancements	Rev 9.40:1998
FC-PLDA	Private Loop Direct Attach	Rev 2.10:1998
FC-SW	Switch Fabric	Rev 3.30:1998

National Committee for Information Technology Standards (NCITS), formerly ANSI X3

STATUS

Projects in development phase

FC-AE	Avionics Environment	Rev 0.40
FC-AV	Audio/Visual	Rev 0.80
FC-BB	Backbone	Rev 0.10
FC-CU TR	Copper Implementation Technical Report	Rev 0.30
FC-GS-2	GS Enhancements	Rev 5.00
FC-SL	Slotted Loop	Rev 4.00
FC-MJS	Methodology of Jitter Specification	Rev 1.00

STATUS

New Project Proposals

FC-AL-3	AL Enhancements
FC-FS	Framing and Signaling Enhancements (combine FC-1 and FC-2 layers from FC-PH, PH-2, and PH-3 in 1 doc)
FC-MJS-2	MJS Enhancements
FC-SW-2	SW Enhancements
FC-TAPE	Tape Profile Technical Report
FC-VI	Virtual Interface Architecture Mapping

FC PRODUCT STATUS

Multiple sources for FC products

- Cables
- Connectors
- Converters
- Host Adapters
- Hubs
- IC-Protocol Chips
- IC-Transceivers
- Internetworking
- Servers
- Software
- Storage Devices
- Storage Systems
- Switches

OS-JTF SORTI OVERVIEW

Avionics Bottlenecks

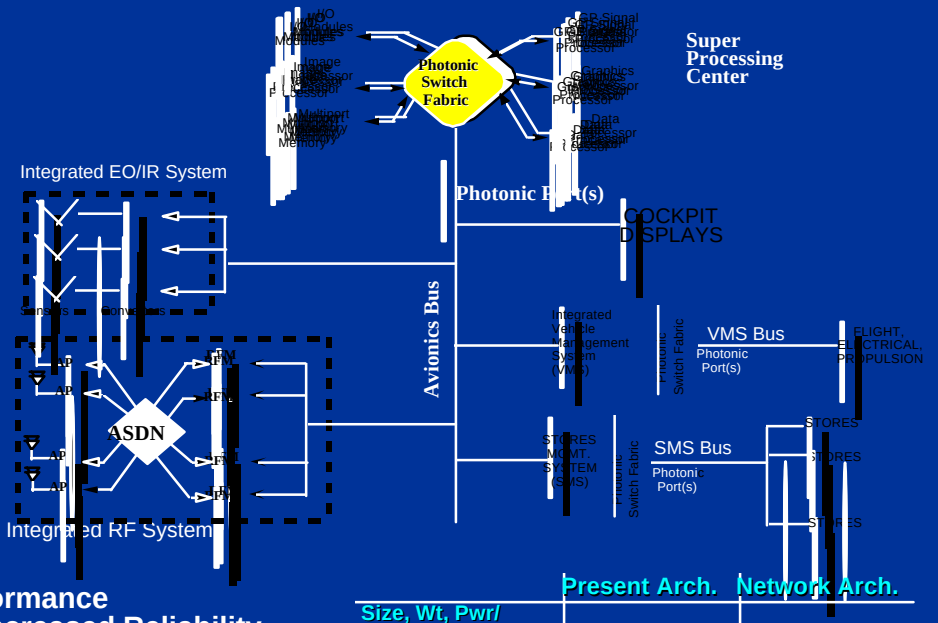
Problem

Communications Limitations Driving Complex, Non-scalable, High Cost Architectures

Solution

Utilize Standard, High-BW, Serial Interconnect

SCALABLE OPTICAL REAL-TIME INTERCONNECT (SORTI)



Customer Goals:

- Lower Cost, Higher Performance
- Reduced Maintenance/ Increased Reliability
- Scaleable Architecture
- Open Architecture
- Standard Interconnect

Significant Improvements:

- Simpler Bus Interconnect
- Reduced I/O Connector Pin Count
- Reduced Interconnect Failure (~1% of all LRU failures)
- Up to 100 Meters Backplane Length
- 16 to 32 Gigabits/Second Bandwidth + Lower EMI Susceptibility

	Present Arch.	Network Arch.
Size, Wt, Pwr/ Unit Bandwidth	2*	1*
I/O Density	400	<60
Reliability/ Failure Rate	~24%**	~1%
Bus Length	0.5M	100M
Performance	100MBps	1000+ MBps
EMI	Susceptible	Immune

*- Normalized
**- % of all LRU Failures

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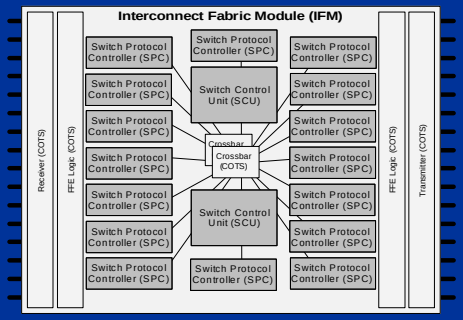
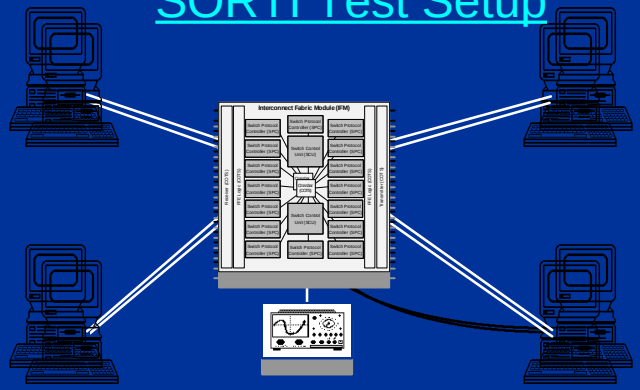
FOLLOW-ON STATUS

SORTI Switch Module



- **Leverage BOIS IR&D Technical Developments**
- **Key Integrating Element for Processing Network**

SORTI Test Setup

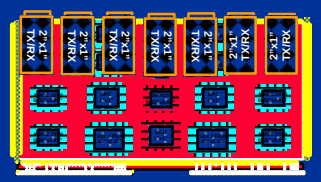


Switch Test & Demonstration Approach

SORTI FY98 Follow-on Development

16 x 16 Single-board Switch

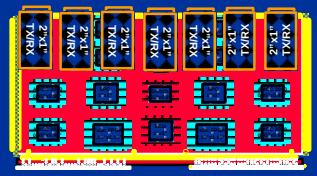
- New ASICs Fabrication
- No Daughtercard
- 6U VME Form-factor
- Full-Featured, Real-Time Fibre Channel
- 1 Gigabaud



SORTI FY99-00 Follow-on

16 x 16 Flight Qualifiable Unit

- No New ASICs
- SEM E or 6U VME
- Full-Featured, Real-Time Fibre Channel
- 1 Gigabaud
- Flight Test Operational Capability in Representative F-15/18 Mission Application



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FC AVIONICS APPLICATIONS

AH-64D Apache Longbow

- Digital Video Interface (DVI) - flight tested
- Multiyear II “Mission Processor” Interconnect - FY2002

F/A-18 Bold Stroke

- COSSI Mission Computer Interface - flight test 7/99
- Advanced Mission Computer and Displays (AMCD) - flight test 8/99

FC AVIONICS APPLICATIONS

AWACS Extend Sentry

- Fibre Channel switched LAN - flight test 5/98

B1-B Block E Computer Upgrade

- FC-AL based interface between avionics computer and data storage/transfer devices

WRAP-UP

Fibre Channel is a mature, open family of standards developed and actively updated/enhanced by an accredited standards body. The layered structure of the standard provides the technology independence necessary to ensure that Fibre Channel can grow as the market needs grow. Through the support of the FCA and FCLC trade associations, the standards are being publicized and Fibre Channel products are readily available from multiple sources.

Info on the Web

T11 Home Page - http://www.dpt.com/T11/

FCA Home Page - http://www.fibrechannel.com

CERN Fibre Channel Home Page - http://www.cern.cs/HSI/fcs